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The First Hours of the Optical Afterglow from the Cosmic Gamma-Ray Burst 030329

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Abstract

We describe the first results of our observations of the exceptionally bright optical afterglow from the cosmic gamma-ray burst (GRB) of March 29, 2003 (030329), with the 1.5-m Russian-Turkish telescope (RTT 150) installed at the TUBITAK National Observatory (Turkey) at Mount Bakyrlytepe. RTT150 was one of the first medium-class telescopes pointed at the afterglow. The observations began as early as about six hours after the GRB. During the first five hours of our observations, the BV RI flux fell off exactly as a power law with the same slope -1.19 ± 0.01. Subsequently, in all of the BV RI bands, we observed the same increase in the power-law slope of the light curve to a value that was later recorded during the observations at observatories in the western hemisphere. The break in the power-law light curve occurs at t - to ≈ 0.57 days (13.5 h) and lasts for about 0.2 days. Apart from this smooth decrease in the flux, the afterglow exhibited no flux variability. The upper limits on the variability are 10-1% on time scales of 0.1-1000 s, respectively. The BV RI spectral flux distribution during the first night of our observations closely corresponds to a power-law spectrum with a spectral index a = 0.66 ± 0.01. The change in the power-law slope of the light curve at the end of our observations is probably attributable to the deceleration of the ultrarelativistic jet to a gamma factor when its structural features begin to show up in the light curve. The radio, optical, and X-ray broadband spectrum is consistent with the assumption about the synchrotron radiation of the ultrarelativistic jet. This unique object continues to be observed with RTT150. © 2003 MAIK "Nauka/Interperiodica".

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Keywords

Afterglows, Cosmic gamma-ray bursts, Optical observations